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PENSOFT

Semiaquatic bugs (Insecta, Heteroptera, Gerromorpha) from Vale do Ribeira, São Paulo state, Brazil

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Abstract

We present a survey of the semiaquatic bugs (Insecta, Heteroptera, Gerromorpha) from Ribeira de Iguape river basin, Vale do Ribeira, São Paulo state, Brazil. Six species of Gerromorpha had been previously recorded from the area based on isolated collection events, namely *Oiovelia brasiliensis* Moreira, Nessimian & Rúdio, 2010, *Rhagovelia accedens* Drake, 1957, *R. aiuruoca* Moreira & Ribeiro, 2009, *R. henryi* Polhemus, 1997, *R. lucida* Gould, 1931, and *R. trepida* Bacon, 1948. Here, we record seven species for the first time from the region: *Microvelia nelsoni* Moreira, Barbosa & Ribeiro, 2012, *M. venustatis* Drake & Harris, 1933, *R. occulcata* Drake, 1959, *R. plaumanni* Polhemus, 1997, *R. robusta* Gould, 1931, *R. zela* Drake, 1959, and *Stridulivelia ayacucho* Polhemus & Spangler, 1995.

Keywords

Aquatic insects, faunistics, Neotropical Region, South America.

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Introduction

The suborder Heteroptera (Insecta, Hemiptera) includes a majority of terrestrial species but also several that occupy aquatic environments (Panizzi and Grazia 2015). Gerromorpha is one of the seven infraorders of Heteroptera and is represented almost entirely by semiaquatic bugs (Moreira et al. 2018). The eight gerromorphan families include about 160 genera and 2,100 extant species (Polhemus and Polhemus 2008). They are predators, playing an important role on aquatic ecosystems, and can be used as indicators of biological quality (Moreira 2015).

Vale do Ribeira is a region encompassing areas from southeastern São Paulo and northeastern Paraná states, including the Ribeira de Iguape river basin and the Iguape-Cananéia-Paranaguá Estuarine lagoon complex. It extends through 2,830,666 ha and 31 municipalities (22 in São Paulo state and nine in Paraná state) (CBH-RB 2019). The region's forests are highly preserved and ecologically diverse, representing about 21% of the remaining Brazilian Atlantic Forest (ISA 1998). It is considered a priority area for conservation due to the high level of endemism and records of threatened species (Langeani et al. 2006).

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Six species of Gerromorpha had been previously recorded from Vale do Ribeira based on isolated collection events: *Oiovelia brasiliensis* Moreira, Nessimian & Rúdio, 2010 (Moreira and Barbosa 2011), *Rhagovelia accedens* Drake, 1957 (Polhemus 1997), *R. aiuruoca* Moreira & Ribeiro, 2009 (Moreira and Barbosa 2011), *R. henryi* Polhemus, 1997 (Moreira and Barbosa 2011), *R. lucida* Gould, 1931 (Polhemus 1997; Moreira and Barbosa 2011), and *R. trepida* Bacon, 1948 (Polhemus 1997; Moreira and Barbosa 2011). Here, we report a survey of the semiaquatic bugs from this underexplored area.

Methods

Fieldwork was carried out monthly during the first semester of 2013, in four stations along the Etá River, Sete Barras, São Paulo state, by active search with the aid of aquatic nets. This river originates from within Intervales State Park and flows into the Ribeira de Iguape River, which is part of the Serra do Mar Environmental Protection Area, located on southern São Paulo state (CBH-RB 2019). Geographic coordinates of the sampling stations were obtained with a GPS receiver. Specimens were fixed and preserved in 80% ethanol, and subsequently deposited in the Entomological Collection of the Oswaldo Cruz Institute, Rio de Janeiro, Brazil (CEIOC). Photographs were obtained using a Leica M205 C stereomicroscope coupled with a Leica DMC2900 digital camera and captured using the Leica LAS imaging system. Maps were produced using QGIS (http://qgis.osgeo.org/). Localities that are too imprecise (e.g., only the country or state is known) are displayed on the maps as question marks.

Results

Representatives of three genera and seven species of the family Veliidae were collected, of which one species is recorded for the first time from São Paulo state and six from Vale do Ribeira.

Family Veliidae
Subfamily Microveliinae
Genus *Microvelia* Westwood, 1834

***Microvelia nelsoni* Moreira, Barbosa & Ribeiro, 2012**
Figures 1, 2

New records. BRAZIL • 2 ♂♂, 3 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 7 Jan. 2013; G. Bertini et al. leg.; CEIOC 74842 • 2 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″ S, 048°06′29″W; 7 Jul. 2013; G. Bertini et al. leg.; CEIOC 74815.

Identification. Our specimens of *M. nelsoni* are all apterous. They were identified based on the body length between 1.70 and 2.00 mm and the pronotum extended posteriorly over almost the entire dorsum of the thorax. In addition, the body is black, with an orange-red mark on the pronotum (Moreira et al. 2012). The distribution of patches of silvery setae on the abdomen is slightly different from the types of this species, but we believe that this represents intraspecific variation only. The original description of *M. nelsoni* indicates that silvery patches occur on the sides of abdominal mediotergites I and III–V, and laterotergites III–VI, whereas there are no silvery patches centrally on mediotergites V–VIII. In our specimens, there are silvery patches on the sides of

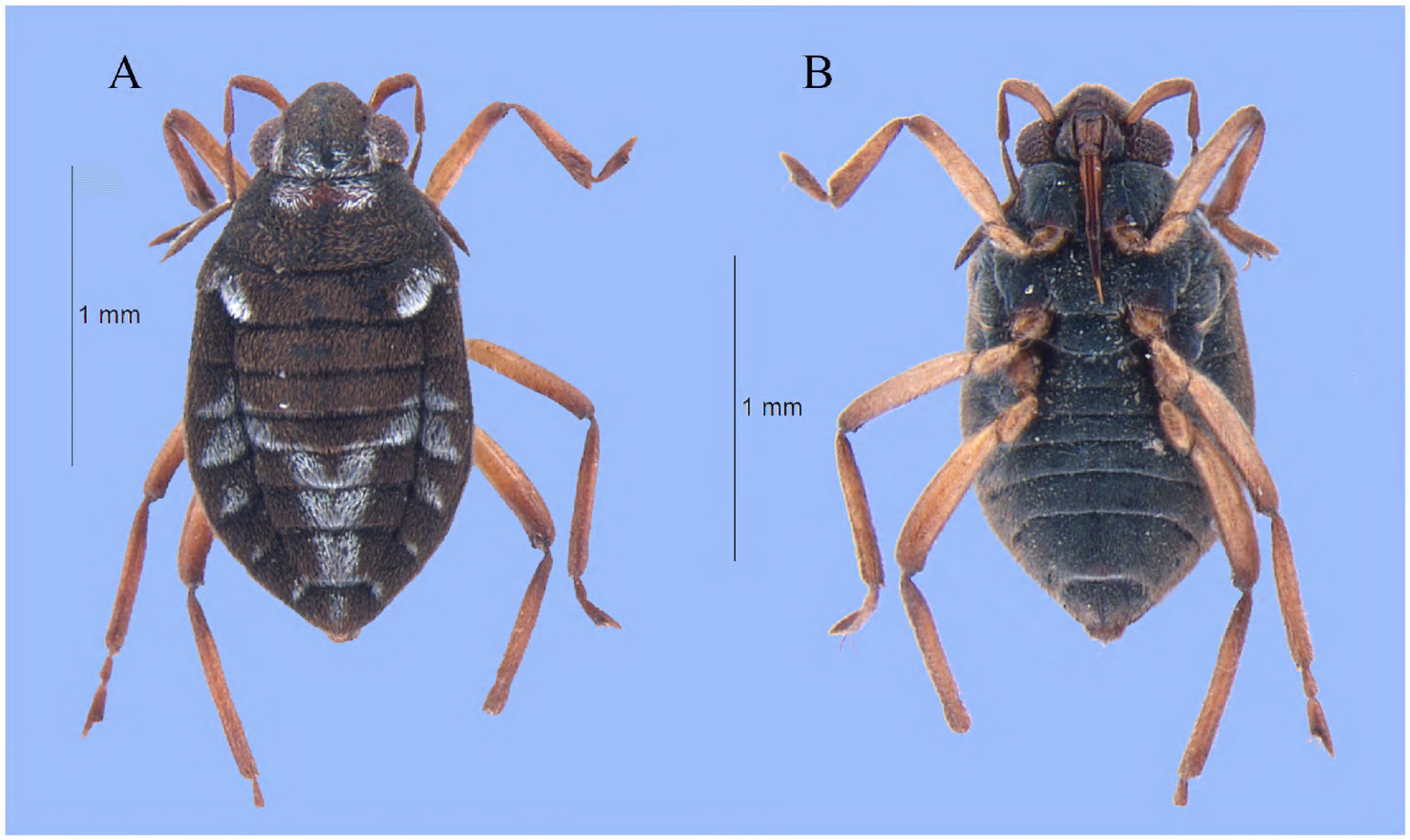

Figure 1. *Microvelia nelsoni*, female. **A.** Dorsal view. **B.** Ventral view.

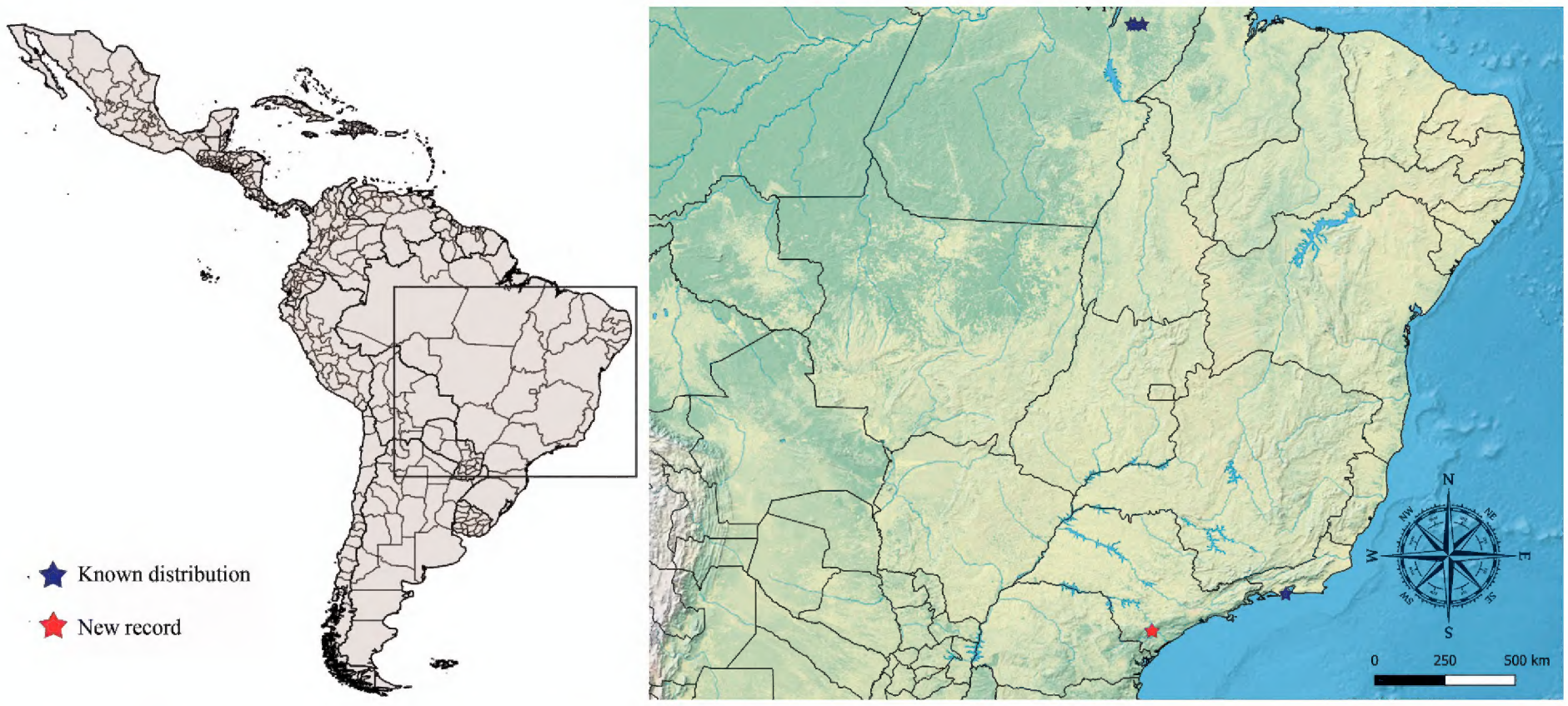

Figure 2. Geographic distribution of *Microvelia nelsoni*.

mediotergites I and III–IV, centrally on mediotergites V–VIII, and on laterotergites III–VII (Fig. 1A).

Known distribution. Brazil (Moreira et al. 2012).

Distribution in Brazil. Pará (Cunha et al. 2015), Rio de Janeiro (Moreira et al. 2012), São Paulo (this work).

Microvelia venustatis Drake & Harris, 1933

Figure 3

New record. BRAZIL • 1 ♂; São Paulo, Vale do Ribeira, Sete Barras, station 2; 24°16′23″S, 048°06′27″W; 7 Jul. 2013; G. Bertini et al. leg.; CEIOC 74823.

Identification. Our male specimen of *M. venustatis* was identified based on the following combination of characters: body about 1.30 mm long, mainly black, with an orange mark on pronotum, without areas of silvery pubescence on abdomen; pronotum leaving central portion of metanotum exposed; antennomeres III–IV subequal to or thicker than I–II; and terminalia small and strongly inserted into the abdomen (Moreira 2012).

Known distribution. Argentina, Brazil, Colombia, Paraguay, Peru (Molano et al. 2016).

Distribution in Brazil. Amazonas (Pereira and Melo 2007, Moreira et al. 2011, Cordeiro and Moreira 2015), Espírito Santo (Moreira et al. 2010), Maranhão (Moreira and Campos 2012), Mato Grosso (Dias-Silva et al. 2013), Minas Gerais (Nieser and Melo 1997; Melo and Nieser 2004), Pará (Moreira et al. 2011; Moreira and Campos 2012; Guterres et al. 2019), Rio de Janeiro (Drake and Hussey 1951), Santa Catarina (Drake and Plaumann 1955), São Paulo (Moreira and Barbosa 2011; Cordeiro and Moreira 2015; this work).

Subfamily Rhagoveliinae

Genus *Rhagovelia* Mayr, 1865

Rhagovelia occulcata Drake, 1959

Figures 4, 5

New records. BRAZIL • 1 ♂, 3 ♀♀; São Paulo, Vale do

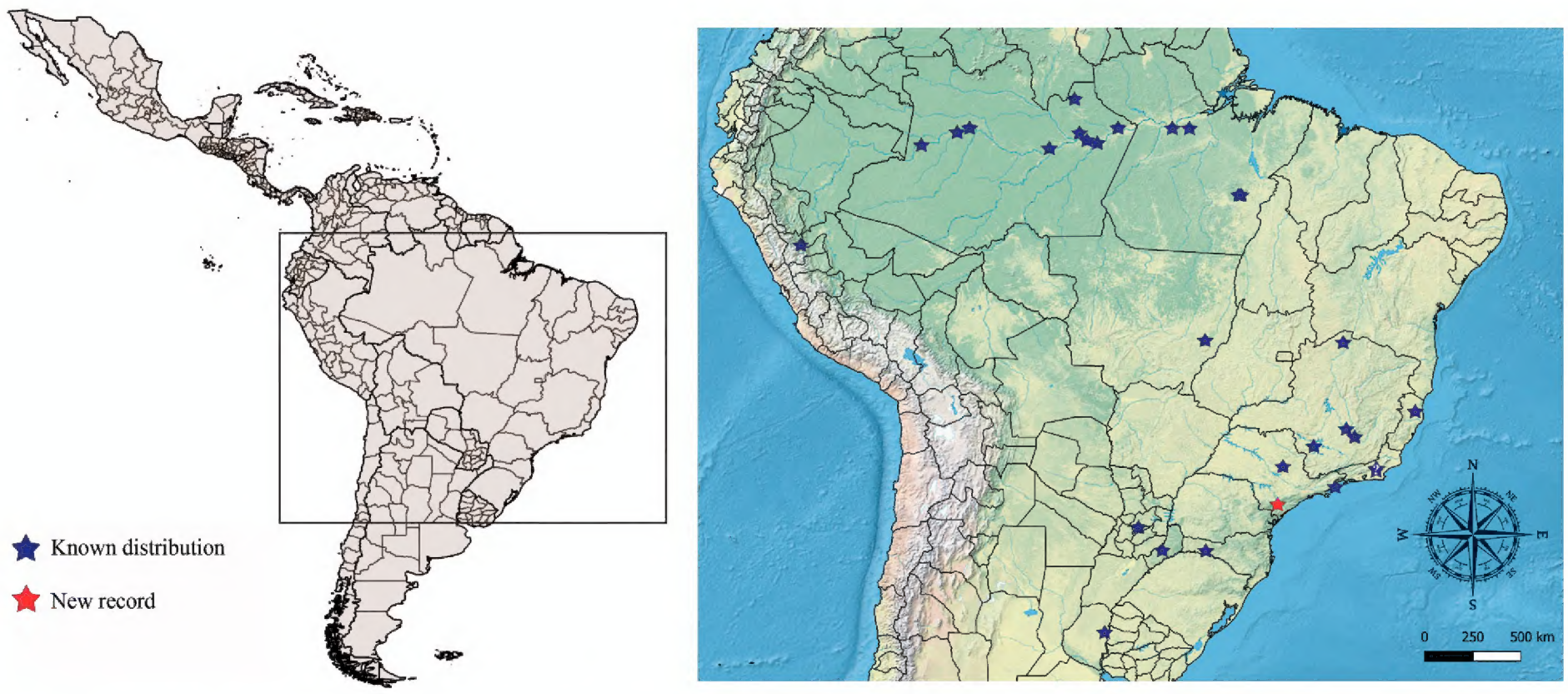

Figure 3. Geographic distribution of *Microvelia venustatis*. Question marks indicate imprecise records.

Figure 4. *Rhagovelia occulcata*. **A.** Male, dorsal view. **B.** Male, ventral view. **C.** Female, dorsal view. **D.** Female, ventral view.

Figure 5. Geographic distribution of *Rhagovelia occulcata*.

Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 7 Jan. 2013; G. Bertini et al. leg.; CEIOC 81501 • 5 ♂♂, 1 ♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74813 • 10 ♂♂, 5 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 7 Mar. 2013; G. Bertini et al. leg.; CEIOC 74816 • 2 ♂♂, 4 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 1;

24°17′31″S, 048°06′29″W; 7 Apr. 2013; G. Bertini et al. leg.; CEIOC 74812 • 40 ♂♂, 9 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 7 Jun. 2013; G. Bertini et al. leg.; CEIOC 74814 • 11 ♂♂, 5 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 8 Jan. 2013; G. Bertini et al. leg.; CEIOC 81502 • 2 ♂♂; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 8 Feb. 2013; G. Bertini et al. leg.; CEIOC 81500 • 2 ♂♂, 1 ♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″ S, 48°6′29″ W; 8 Mar. 2013; G. Bertini et al. leg.; CEIOC 74818 • 3 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 2; 24°16′23″S, 048°06′27″W; 7 Jan. 2013; G. Bertini et al. leg.; CEIOC 81504 • 6 ♂♂, 15 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 2; 24°16′23″S, 048°06′27″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74810 • 2 ♂♂; São Paulo, Vale do Ribeira, Sete Barras, station 2; 24°16′23″S, 048°06′27″W; 7 Apr. 2013; G. Bertini et al. leg.; CEIOC 74820 • 1 ♂, 12 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 2; 24°16′23″S, 048°06′27″W; 7 May 2013; G. Bertini et al. leg.; CEIOC 74822 • 5 ♂♂, 7 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 2; 24°16′23″ S, 48°6′27″ W; 7 Jun. 2013; G. Bertini et al. leg.; CEIOC 74821 • 18 ♂♂, 22 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 2; 24°16′23″S, 048°06′27″W; 8 Jan. 2013; G. Bertini et al. leg.; CEIOC 81504 • 12 ♂♂, 16 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 7 Jan. 2013; G. Bertini et al. leg.; CEIOC 81506 • 2 ♂♂, 6 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74824 • 2 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 7 Mar. 2013; G. Bertini et al. leg.; CEIOC 74833 • 1 ♂; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 7 Apr. 2013; G. Bertini et al. leg.; CEIOC 74825 • 1 ♂; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 7 May 2013; G. Bertini et al. leg.; CEIOC 74834 • 19 ♂♂, 13 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″ S, 48°6′29″ W; 7 Jun. 2013; G. Bertini et al. leg.; CEIOC 74829 • 6 ♂♂, 7 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 8 Feb. 2013; G. Bertini et al. leg.; CEIOC 74826 • 1 ♀; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 8 Jun. 2013; G. Bertini et al. leg.; CEIOC 74832 • 2 ♂♂, 5 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Jan. 2013; G. Bertini et al. leg.; CEIOC 81507 • 12 ♂♂; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74837 • 7 ♂♂, 10 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Mar. 2013; G. Bertini et al. leg.; CEIOC 81503 • 6 ♂♂, 11 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 May 2013; G. Bertini et al. leg.; CEIOC 74845 • 15 ♂♂, 9 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Jun. 2013; G. Bertini et al. leg.; CEIOC 74838 • 4 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 8 Jan. 2013; G. Bertini et al. leg.; CEIOC 81509 • 1 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 8 Mar. 2013; G. Bertini et al. leg.; CEIOC 81511.

Identification. *Rhagovelia occulcata* belongs to the *angustipes* complex of species based on the pronotum of the apterous form shorter than the dorsal length of the eye (Polhemus 1997). Males examined have fore trochanter without spines, middle coxa blackish, hind femur with a single spine near middle of posterior surface, and abdominal mediotergite VII as long as its anterior width. Females could be determined based on the hind femur without spines and abdominal laterotergites distinctly thickened posteriorly, strongly convergent, almost touching above mediotergite VII (Moreira 2012).

Known distribution. Brazil (Moreira and Barbosa 2011).

Distribution in Brazil. Paraná (Drake 1959), São Paulo (Nieser and Polhemus 1999; Moreira and Barbosa 2011; this work).

Rhagovelia plaumanni Polhemus, 1997

Figures 6, 7

New record. BRAZIL • 1 ♂; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″0S, 048°06′29″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74827.

Identification. *Rhagovelia plaumanni* belongs to the *robusta* group of species, in which the pronotum of the apterous form completely covers the mesonotum, the distal spur of the hind tibia is straight or slightly curved, never crescent-shaped, and the posterolateral margins of male abdominal segment VII lack robust black denticles (Polhemus 1997; Moreira et al. 2012). The male above was identified based on the key provided by Magalhães et al. (2016). This specimen bears proepisternum without black denticles, hind femur lacking a long, sharp spine removed dorsally from the two rows of spines along the posterior margin, hind tibia with several subequal spines, in addition to the apical spur, abdominal mediotergite VII shining black, and sides of abdominal segment VII without patches of black denticles.

Known distribution. Brazil, Paraguay (Polhemus 1997).

Distribution in Brazil. Paraná (Polhemus 1997), Rio Grande do Sul (Polhemus 1997), Santa Catarina (Polhemus 1997), São Paulo (Polhemus 1997; this work).

Rhagovelia robusta Gould, 1931

Figures 8, 9

New records. BRAZIL • 1 ♀; São Paulo, Vale do Ribeira, Sete Barras, station 1; 24°17′31″S, 048°06′29″W; 7 Mar. 2013; G. Bertini et al. leg.; CEIOC 74811 • 1 ♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Jan. 2013; G. Bertini et al. leg.; CEIOC 81510 • 1 ♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74836 • 1 ♀; São Paulo, Vale do

Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Mar. 2013; G. Bertini et al. leg.; CEIOC 74835 • 2 ♂♂; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 8 Feb. 2013; G. Bertini et al. leg.; CEIOC 74841.

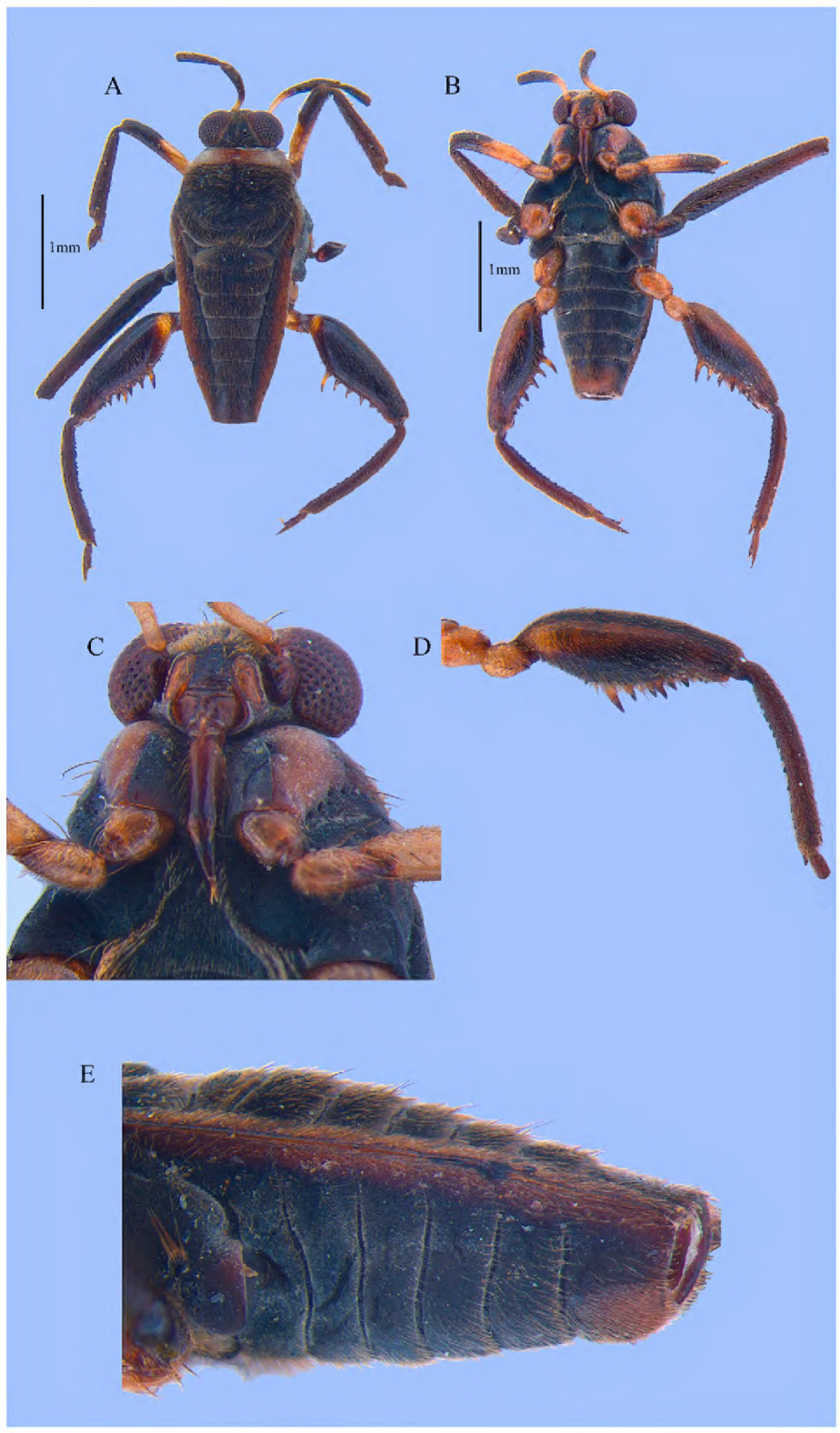

Figure 6. *Rhagovelia plaumanni*, male. **A.** Dorsal view, terminalia removed. **B.** Ventral view, terminalia removed. **C.** Head, pro- and mesothorax, ventral view. **D.** Hind leg, ventral view. **E.** Metathorax and abdomen, lateral view, terminalia removed.

Identification. Like *R. plaumanni*, *R. robusta* belongs to the *robusta* group of species (Polhemus 1997; Moreira et al. 2012). Their males can be readily distinguished by the presence of a large preapical spine on the hind tibia of the latter, which is absent on the former. Additionally, the males of *R. robusta* were identified based on the pronotum mostly blackish, strongly contrasting with a yellowish brown mark on anterior lobe, jugum and proepisternum with minute black denticles, hind trochanter with spines, hind femur with three irregular rows of spines, with a large spine near its middle dorsally displaced from the others, and sides of abdominal segment VII without patches of black denticles (Magalhães et al. 2016). The females above were identified by association with the males available from the study area and comparison with other females of *R. robusta* from São Paulo state deposited in the CEIOC.

Known distribution. Argentina, Brazil, Paraguay (Magalhães et al 2016).

Distribution in Brazil. Espírito Santo (Moreira et al. 2010), Goiás (Polhemus 1997), Mato Grosso (Dias-Silva et al. 2013; Giehl et al. 2018), Minas Gerais (Polhemus 1997; Nieser and Melo 1997; Souza et al. 2006; Taylor and Ferreira 2012; Moreira and Barbosa 2012), Pará (Moreira and Campos 2012), Rio de Janeiro (Moreira and Ribeiro 2009), Santa Catarina (Polhemus 1997), São Paulo (Moreira and Barbosa 2011; Castanhole et al. 2013; this work), Sergipe (Moreira and Campos 2012).

Rhagovelia zela Drake, 1959

Figures 10, 11

New records. BRAZIL • 2 ♂♂; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 7 Jun. 2013; G. Bertini et al. leg.; CEIOC 74830 • 1 ♂; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Jan. 2013; G. Bertini et al.

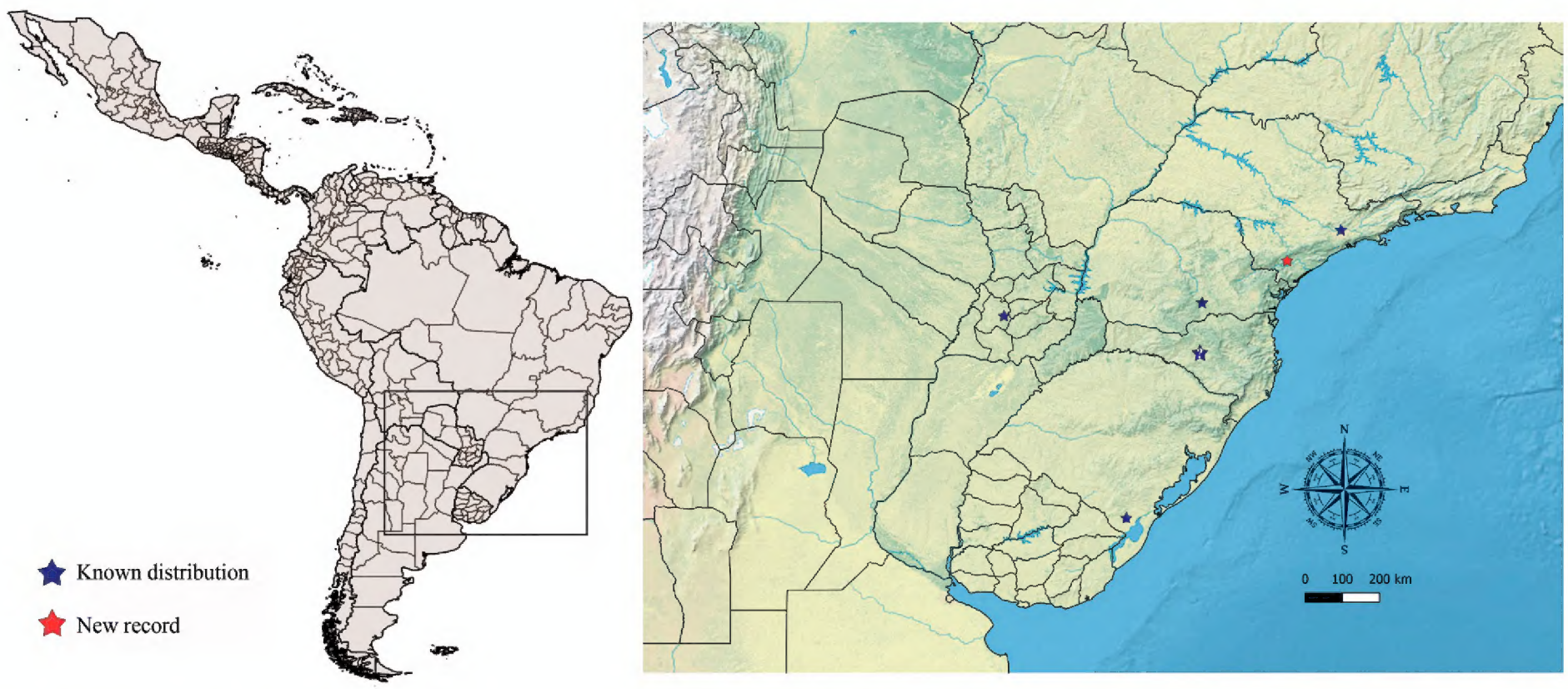

Figure 7. Geographic distribution of *Rhagovelia plaumanni*. Question marks indicate imprecise records.

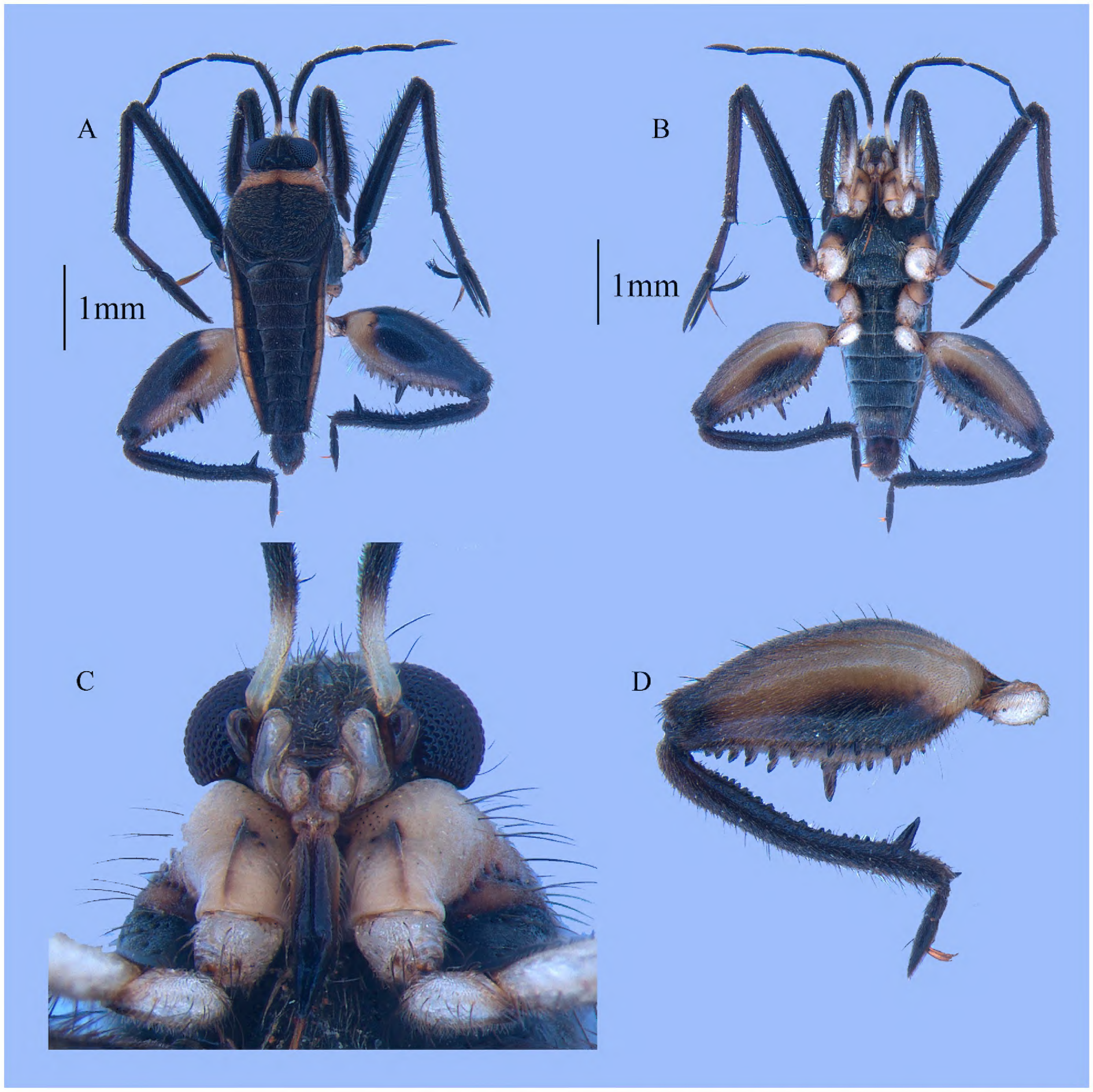

Figure 8. *Rhagovelia robusta*, male. **A.** Dorsal view. **B.** Ventral view. **C.** Head and prothorax, ventral view. **D.** Hind leg, ventral view.

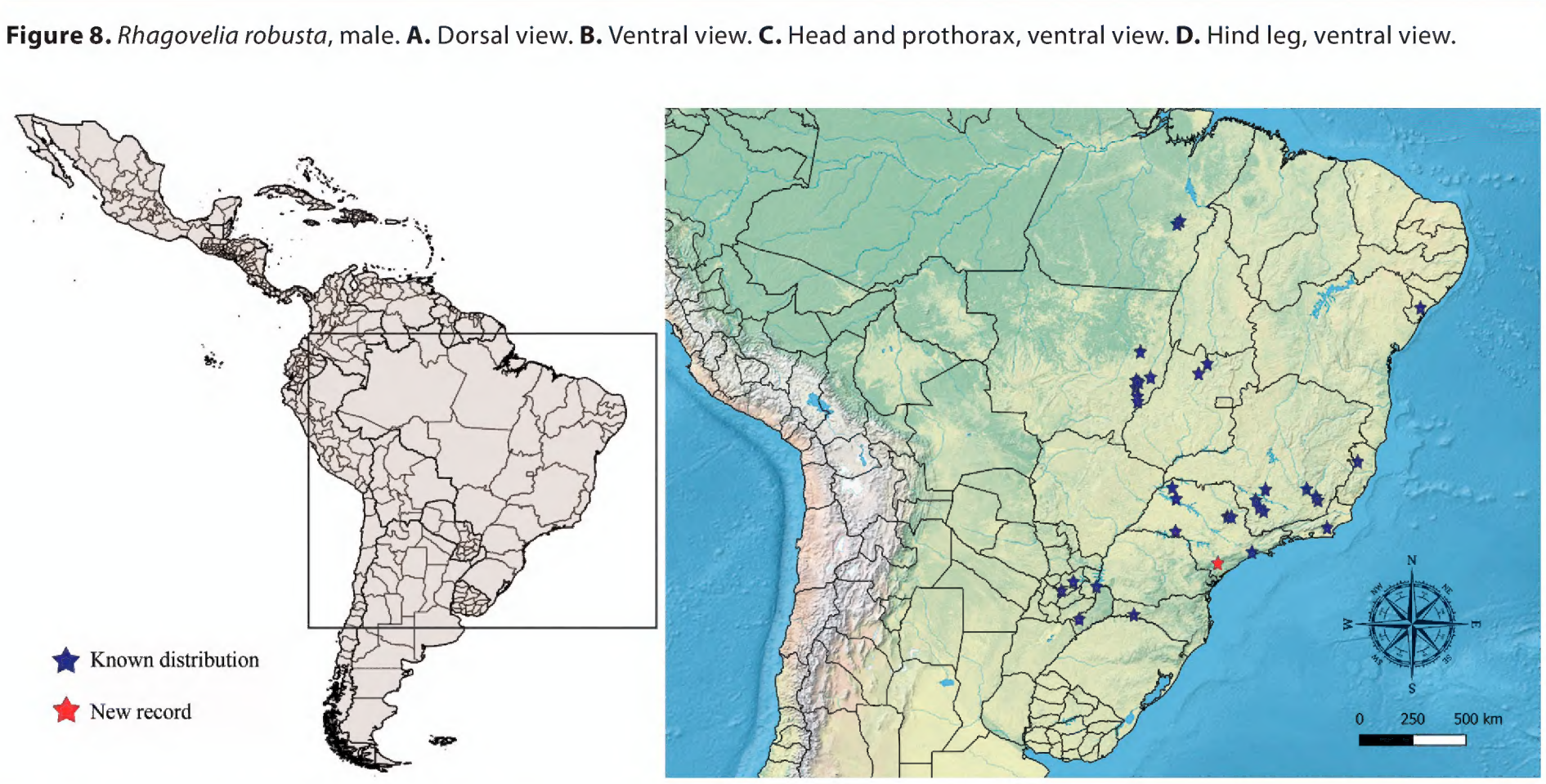

Figure 9. Geographic distribution of *Rhagovelia robusta*.

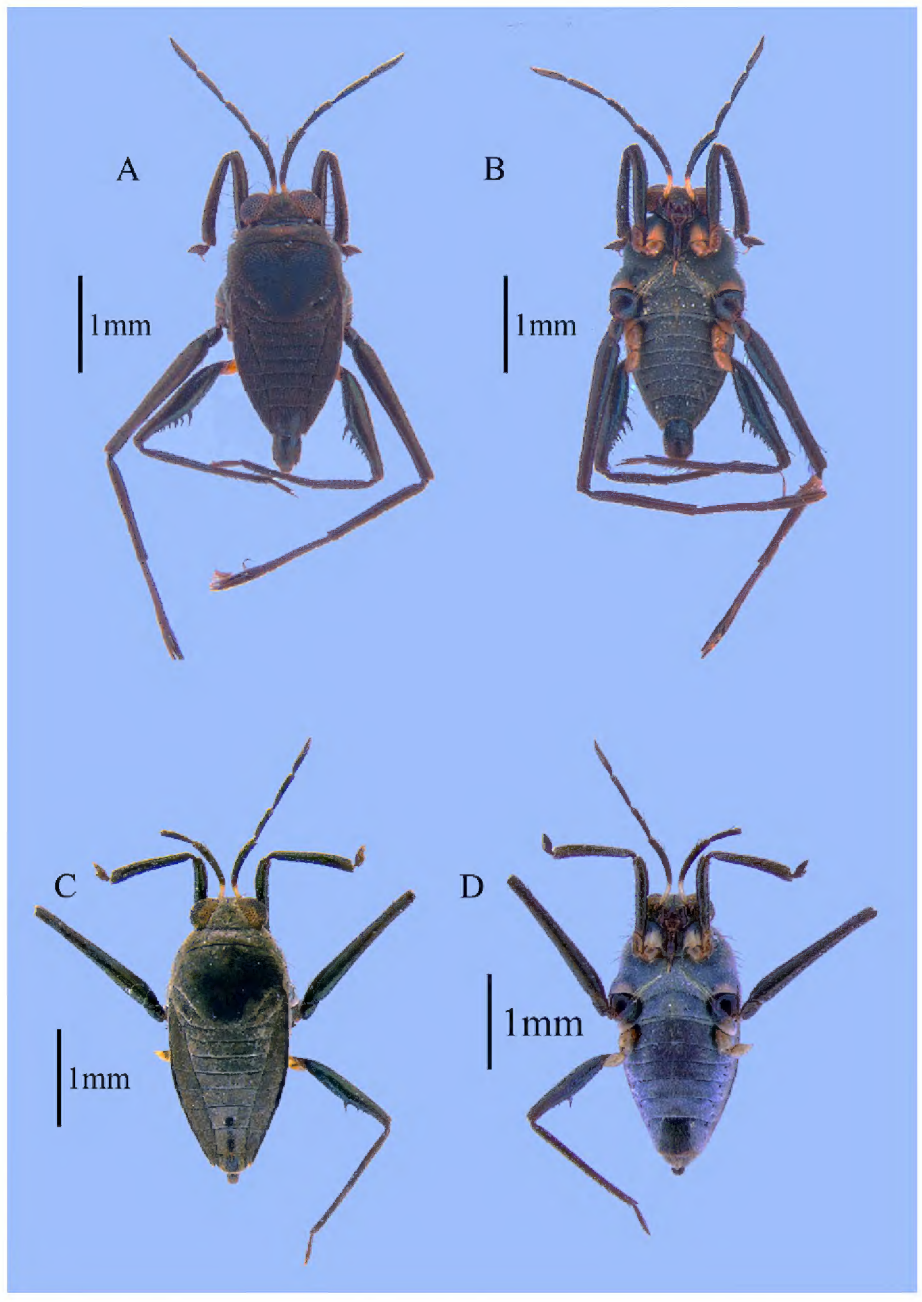

Figure 10. *Rhagovelia zela*. **A.** Male, dorsal view. **B.** Male, ventral view. **C.** Female, dorsal view. **D.** Female, ventral view.

leg.; CEIOC 81508 • 2 ♂♂; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74838 • 1 ♂; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Mar. 2013; G. Bertini et al. leg.; CEIOC 74843 • 1 ♂; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Apr. 2013; G. Bertini et al. leg.; CEIOC 74849 • 7 ♂♂, 1 ♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 May 2013; G. Bertini et al. leg.; CEIOC 74846 • 5 ♂♂, 2 ♀♀; São Paulo, Vale do Ribeira, Sete Barras, station 4; 24°18′11″S, 048°06′09″W; 7 Jun. 2013; G. Bertini et al. leg.; CEIOC 74847.

Identification. Like *R. occulcata*, *R. zela* belongs to the *angustipes* complex of species (Polhemus 1997). The two can be easily distinguished based on the hind femur with several spines on the latter, whereas the former has only one spine on the male and no spines on the female. Furthermore, our males of *R. zela* were identified based on the fore trochanter without spines, middle coxa blackish, and only abdominal mediotergite VII and terminalia with shining black areas. The females could be diagnosed by the antennomere II shorter than III, middle coxa blackish, hind trochanter yellowish, and abdominal laterotergites not reflexed over the mediotergites (Moreira 2012). Females of this species typically have a shining black area on abdominal mediotergite VIII and sometimes also a small mark on mediotergite VII. Our specimens have an additional small mark on mediotergite VI (Fig. 10C).

Known distribution. Brazil (Cordeiro and Moreira 2015).

Distribution in Brazil. Espírito Santo (Moreira et al. 2010), Goiás (Cordeiro and Moreira 2015), Mato Grosso (Dias-Silva et al. 2013), Mato Grosso do Sul (Floriano et al. 2013), Minas Gerais (Moreira and Barbosa 2012), Rio de Janeiro (Moreira and Ribeiro 2009; Moreira et al. 2012), Santa Catarina (Drake 1959), São Paulo (Moreira and Barbosa 2011; Castanhole et al. 2013; Pereira et al. 2015; this work).

Subfamily Veliinae
Genus *Stridulivelia* Hungerford, 1929

***Stridulivelia ayacucho* Polhemus & Spangler, 1995**
Figures 12, 13

New record. BRAZIL • 1 ♂, 1♀; São Paulo, Vale do Ribeira, Sete Barras, station 3; 24°17′31″S, 048°06′29″W; 7 Feb. 2013; G. Bertini et al. leg.; CEIOC 74828.

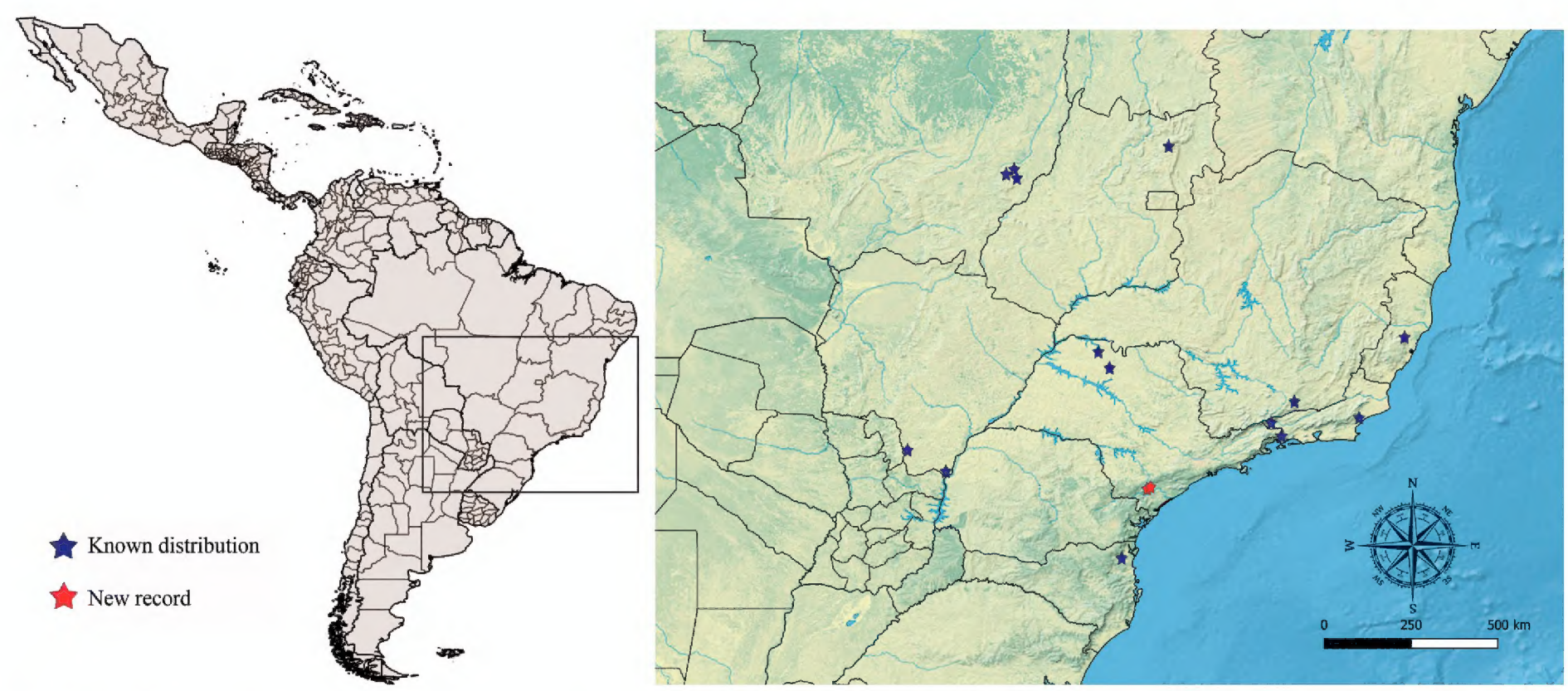

Figure 11. Geographic distribution of *Rhagovelia zela*.

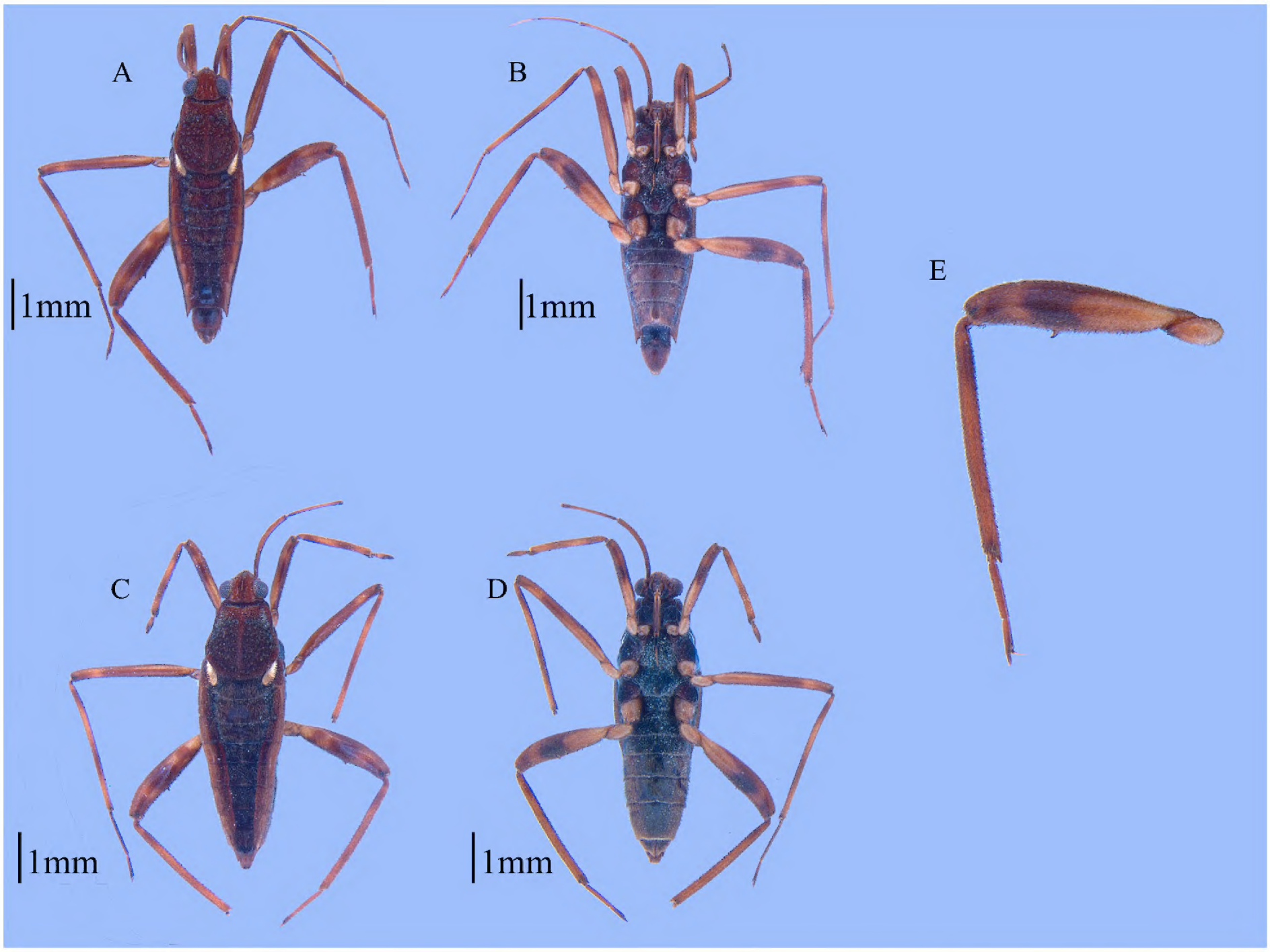

Figure 12. *Stridulivelia ayacucho*. **A.** Male, dorsal view. **B.** Male, ventral view. **C.** Female, dorsal view. **D.** Female, ventral view. **E.** Hind leg, ventral view.

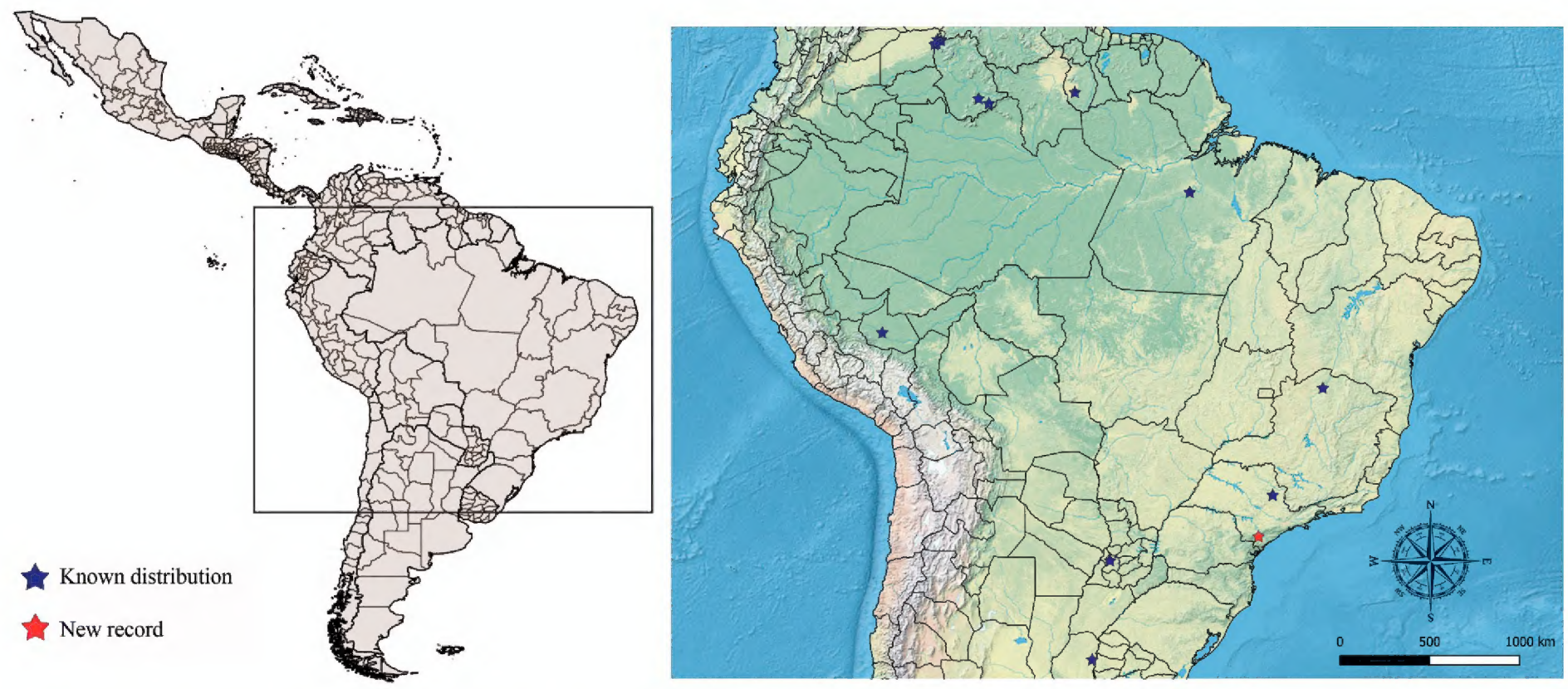

Figure 13. Geographic distribution of *Stridulivelia ayacucho*.

Identification. Our material was identified based on the key provided by Floriano et al. (2017). The two specimens above have pronotal humeral angles rounded, not spinose; stridulatory structure on laterotergites formed by a row of widely separated knob-like denticles; and hind femur incrassate, about 2.5 times wider than middle femur, with a spine on distal two-thirds of posterior margin distinctly larger than others. The male has the venter of abdominal segment VIII centrally expanded, but not forming a lobule, and the female has short posterior projections on the dorsum of abdominal segment VIII, with about one-third the length of the segment at midline.

Known distribution. Argentina, Bolivia, Brazil, Guyana, Paraguay, Peru, Venezuela (Floriano et al 2017).

Distribution in Brazil. Minas Gerais (Melo and Nieser

2004), Pará (Polhemus and Spangler 1995), São Paulo (Moreira and Barbosa 2011; this work).

Discussion

Among the species identified, *Microvelia nelsoni* is recorded for the first time from São Paulo state. It was described from the Tijuca Forest National Park, Rio de Janeiro state (Moreira et al. 2012) and subsequently recorded only from northeastern Pará state (Cunha et al. 2015). The new records herein presented expand its distribution by about 500 km southward.

The remaining six species represented in our samples are new for the Vale do Ribeira region. *Microvelia venustatis* is widely distributed in South America (Molano et al. 2016) and was previously reported from localities on northeastern and central São Paulo state (Moreira and Barbosa 2011; Cordeiro and Moreira 2015). The new record we provide lies in a gap between the nearest occurrences to the north (São Paulo state, Ubatuba, Serra do Mar State Park, ca 350 km; Cordeiro and Moreira 2015) and to the south (Santa Catarina state, Seara, Nova Teutônia, ca 530 km; Drake and Plaumann 1955).

Rhagovelia occulcata is poorly represented in entomological collections and has only four published records (Drake 1959; Nieser and Melo 1997; Nieser and Polhemus 1999; Moreira and Barbosa 2011). However, this species was by far the most abundant species in our study area during the entire sampling period. It is probably endemic to portions of Serra da Mantiqueira and Serra do Mar mountain ranges in São Paulo and Paraná states. The nearest record is from Turvo River at São Miguel Arcanjo, about 30 km north of Vale do Ribeira (Moreira and Barbosa 2011).

Previous records of *R. plaumanni* were all published together with the original description of the species and are restricted to localities within the Río de La Plata Basin in Paraguay and southern Brazil (Polhemus 1997). The record herein presented lies between the nearest occurrences to the north (São Paulo state, São Paulo, ca 175 km; Polhemus 1997) and to the south (Paraná state, Rio Azul, ca 300 km; Polhemus 1997), and is the first from the Southeastern Atlantic Hydrographic Region.

Rhagovelia robusta is distributed from southeastern Pará state and Sergipe state, in Brazil, south to Misiones province in Argentina (Magalhães et al. 2016). It has a few published reports from São Paulo state (Moreira and Barbosa 2011; Castanhole et al. 2013), among which the nearest from our study area lies approximately 190 km to the northeast (Santo André, Paranapiacaba).

Rhagovelia zela occurs in central and southern Brazil (Cordeiro and Moreira 2015) and has two previous records from northwestern São Paulo state (Moreira and Barbosa 2011; Pereira et al. 2015). However, the record nearest to ours is from the type locality in Guaramirim, northeastern Santa Catarina state, about 260 km to the south (Drake 1959).

Finally, published records of *Stridulivelia ayacucho* are scattered throughout South America, from Amazonas state, in southern Venezuela, and Upper Takutu-Upper Essequibo, in southern Guyana (Polhemus and Spangler 1995), to Entre Ríos province in Argentina (Torres et al. 2007). The occurrence nearest to our study area is from central São Paulo (Pirassununga, Centro Nacional de Pesquisa e Conservação da Biodiversidade Aquática Continental-CEPTA; Moreira and Barbosa 2011), the only published so far from the state.

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Authors' Contributions

OMM identified specimens, composed the maps and wrote the manuscript. LN organized, deposited and photographed specimens. HM collected and sorted specimens. GB conceived and designed the experiments, performed the samplings, revised the manuscript and approved the final draft. RP sorted specimens, revised the manuscript and approved the final draft. FFFM identified specimens, revised the manuscript and approved the final draft.

References

Castanhole MMU, Marchesin SRC, Pereira LLV, Moreira FFF, Barbosa JF, Valério JR, Itoyama MM (2013) The first assess of the haplotypes from COI gene sequences in species of spittlebugs (Cicadomorpha: Hemiptera) and aquatic true bugs (Gerromorpha and Nepomorpha: Hemiptera) in Brazil. Genetics and Molecular Research 12 (4): 5372–5381. https://doi.org/10.4238/2013.November.7.12

Comitê da Bacia Hidrográfica do Ribeira de Iguape e Litoral Sul [CBH-RB] (2019) Sistema de Informações Geográficas da Bacia do Ribeira de Iguape e Litoral Sul. https://www.sigrb.com.br/. Accessed on: 2019-12-3.

Cordeiro IRS, Moreira FFF (2015) New distributional data on aquatic and semiaquatic bugs (Hemiptera: Heteroptera: Gerromorpha & Nepomorpha) from South America. Biodiversity Data Journal 3: e4913. https://doi.org/10.3897/BDJ.3.e4913

Cunha EJ, Montag LFA, Juen L (2015) Oil palm crops effects on environmental integrity of Amazonian streams and Heteropteran (Hemiptera) species diversity. Ecological Indicators 52: 422–429. https://doi.org/10.1016/j.ecolind.2014.12.024

Dias-Silva K, Moreira FFF, Giehl NFS, Nóbrega CC, Cabette HSR (2013) Gerromorpha (Hemiptera: Heteroptera) of eastern Mato Grosso State, Brazil: checklist, new records, and species distribution modeling. Zootaxa 3736 (3): 201–235. https://doi.org/10.11646/zootaxa.3736.3.1

Drake CJ (1959) Three new water-striders from Brazil (Hemiptera). Bulletin of the Southern California Academy of Sciences 58 (2): 107–111.

Drake CJ, Hussey RF (1951) Concerning some American *Microvelia* (Hemiptera: Veliidae). Florida Entomologist 34 (4): 137–145. https://doi.org/10.2307/3492444

Drake CJ, Plaumann F (1955) Some *Microvelia* from southern Brazil (Hemiptera: Veliidae). Bulletin of the Southern California Academy of Sciences 54 (1): 22–24.

Floriano CFB, Moreira FFF, Bispo PC (2017) South American species of *Stridulivelia* (Hemiptera: Heteroptera: Veliidae): identification key, diagnoses, illustrations, and updated distribution. Proceedings of the Entomological Society of Washington 119 (1): 24–46. https://doi.org/10.4289/0013-8797.119.1.24

Floriano CFB, Oliveira IADV, Melo AL (2013) New records and checklist of aquatic and semi-aquatic Heteroptera (Insecta: Hemiptera: Gerromorpha and Nepomorpha) from the southern region of Mato Grosso do Sul, Brazil. Biota Neotropica 13 (1): 210–219. https://doi.org/10.1590/S1676-06032013000100022

Giehl NFS, Resende BO, Roges PFSS, Dias-Silva K, Nogueira DS, Cabette HSR (2018) Diversidade de presas e predadores (Insecta) em mesohabitats de córregos de Cerrado. Iheringia, Série Zoologia 108: e2018042. https://doi.org/10.1590/1678-4766e2018042

Guterres APM, Cunha EJ, Godoy BS, Silva RR, Juen L (2019) Co-occurrence patterns and morphological similarity of semiaquatic insects (Hemiptera: Gerromorpha) in streams of eastern Amazonia. Ecological Entomology [early view]. https://doi.org/10.1111/een.12785

Instituto Socioambiental [ISA] (1998) Diagnóstico Socioambiental do Vale do Ribeira: Documento Síntese. Instituto Socioambiental, São Paulo, 67 pp.

Langeani F, Casatti L, Menezes NA, Oyakawa OT, Braga FMS, Nalon MA, Martinelli LA (2006) Workshop de áreas continentais prioritárias para conservação e restauração da biodiversidade no Estado de São Paulo: a contribuição dos peixes de água doce na identificação de áreas prioritárias para conservação e restauração no Estado de São Paulo. https://www.biota.org.br/info/wap2006/. Accessed on: 2019-12-3.

Magalhães OM, Moreira FFF, Galvão C (2016) A new species of *Rhagovelia* Mayr, 1865 (Hemiptera: Heteroptera: Veliidae) from Pará State, with an updated key to Brazilian species of the *robusta* group. Zootaxa 4171 (3): 586–594. https://doi.org/10.11646/zootaxa.4171.3.12

Melo AL, Nieser N (2004) Faunistical notes on aquatic Heteroptera of Minas Gerais (Brazil): an annotated list of Gerromorpha and Nepomorpha collected near Januária, MG. Lundiana 5 (1): 43–49.

Molano F, Moreira FFF, Morales I (2016) New species and records of Microveliinae and Veliinae (Hemiptera: Heteroptera: Veliidae) from Colombia. Zootaxa 4171 (3): 575–585. https://doi.org/10.11646/zootaxa.4171.3.11

Moreira FFF (2012) Sinopse da fauna de Veliidae (Insecta: Heteroptera: Gerromorpha) ocorrente na Região Sudeste do Brasil. PhD dissertation, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 369 pp.

Moreira FFF (2015) The semiaquatic gerromorphans. In: Panizzi AR, Grazia J (Eds) True bugs (Heteroptera) of the Neotropics. Springer Science+Business Media, Dordrecht, 113–156. https://doi.org/10.1007/978-94-017-9861-7_6

Moreira FFF, Barbosa JF (2011) The Veliidae (Hemiptera: Heteroptera: Gerromorpha) from São Paulo State, Brazil: new species, description of the male of *Microvelia ioana* Drake & Hottes, 1952, and synonymical and distributional notes. Annales de Limnologie 47: 297–311. https://doi.org/10.1051/limn/2011010

Moreira FFF, Barbosa JF (2012) Two new species of *Paravelia* Breddin, 1898 and distributional notes concerning the Veliidae from Minas Gerais state, Brazil (Insecta: Hemiptera: Heteroptera: Gerromorpha). Zootaxa 3354: 58–68. https://doi.org/10.11646/zootaxa. 3354.1.2

Moreira FFF, Barbosa JF, Nessimian JL (2011) Description of *Microvelia urucara* sp. nov. and new distributional data on veliids (Insecta: Heteroptera: Veliidae) from the Amazon River floodplain, Brazil. Zoologia 28 (5): 658–662. https://doi.org/10.1590/S1984-46702011000500014

Moreira FFF, Barbosa JF, Ribeiro JRI (2012) Veliidae (Insecta, Heteroptera, Gerromorpha) from southeastern Brazil: three new species from Rio de Janeiro state, a new species group for Neotropical *Rhagovelia* Mayr, and notes on distribution and synonymy. Revista Brasileira de Entomologia 56 (2): 147–158. https://doi.org/10.1590/S0085-56262012005000023

Moreira FFF, Campos GGF (2012) New distributional data concerning some Gerromorpha (Insecta: Hemiptera: Heteroptera) from Brazil. Check List 8 (3): 542–547. https://doi.org/10.15560/8.3.542

Moreira FFF, Nessimian JL, Rúdio JA, Salles FF (2010) New species and new records of Veliidae from Espírito Santo State and adjacent Minas Gerais state, Brazil, with notes on nomenclature (Insecta: Heteroptera: Gerromorpha). Journal of Natural History 44 (45): 2761–2801. https://doi.org/10.1080/00222933.2010.512423

Moreira FFF, Ribeiro JRI (2009) Two new *Rhagovelia* (Heteroptera: Veliidae) and new records for twelve species in southeastern Brazil. Aquatic Insects 31 (1): 45–61. https://doi.org/10.1080/01650420802444449

Moreira FFF, Rodrigues HDD, Sites RW, Cordeiro IRS, Magalhães OMM (2018) Order Hemiptera. In: Hamada N, Thorp JH, Rogers DC (Eds) Thorp and Covich's freshwater invertebrates, fourth edition. Elsevier, London, 175–216. https://doi.org/10.1016/B978-0-12-804223-6.00007-X

Nieser N, Melo AL (1997) Os heterópteros aquáticos de Minas Gerais: guia introdutório com chave de identificação para as espécies de Nepomorpha e Gerromorpha. Editora UFMG, Belo Horizonte, 180 pp.

Nieser N, Polhemus DA (1999) Four new species of *Rhagovelia* (Heteroptera: Veliidae) from Minas Gerais (Brazil), with a key to the regional species of the *angustipes* complex. Aquatic Insects 21 (1): 53–76. https://doi.org/10.1076/aqin.21.1.53.4540

Panizzi AR, Grazia J (2015) True bugs (Heteroptera) of the Neotropics. Springer Science+Business Media, Dordrecht, 901 pp. https://doi.org/10.1007/978-94-017-9861-7

Pereira DLV, Melo AL (2007) Aquatic and semiaquatic Heteroptera (Insecta) from Pitinga, Amazonas, Brazil. Acta Amazonica 37 (4): 643–648. https://doi.org/10.1590/S0044-59672007000400021

Pereira LLV, Alevi KCC, Castanhole MMU, Moreira FFF, Barbosa JF, Itoyama MM (2015) Cytogenetics analysis and testis morphology of aquatic species of the families Belostomatidae, Gelastocoridae, Gerridae, Notonectidae, and Veliidae (Heteroptera). Journal of Insect Science 15 (21). https://doi.org/10.1093/jisesa/iev009

Polhemus DA (1997) Systematics of the genus *Rhagovelia* Mayr (Heteroptera: Veliidae) in the Western Hemisphere (exclusive of the *angustipes* complex). Entomological Society of America, Lanham, 386 pp.

Polhemus JT, Polhemus DA (2008) Global diversity of true bugs (Heteroptera; Insecta) in freshwater. Hydrobiologia 595: 379–391. https://doi.org/10.1007/978-1-4020-8259-7_40

Polhemus JT, Spangler PJ (1995) A review of the genus *Stridulivelia* Hungerford and two new species (Heteroptera: Veliidae) from South America. Proceedings of the Entomological Society of Washington 97 (1): 128–152.

Souza MAA, Melo AL, Vianna GJC (2006) Heterópteros aquáticos oriundos do Município de Mariana, MG. Neotropical Entomology 35 (6): 803–810. https://doi.org/10.1590/S1519-566X2006000600013

Taylor ELS, Ferreira RLL (2012) Determinants on the structure of an aquatic invertebrate community in a Neotropical limestone cave. Revista Brasileira de Espeleologia 2 (1): 1–12.